Introduction to AI ML

EE1390

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Problem

A straight line L through the point (3,-2) is inclined at 60° to the line

$$\sqrt{3}x + y = 1$$

. If L also intersects the x-axis, then the equation of L is

(a)

$$y + \sqrt{3}y + 2 - 3\sqrt{3} = 0$$

(b)

$$y - \sqrt{3}x + 2 + 3\sqrt{3} = 0$$

(c)

$$\sqrt{3}y - x + 3 + 2\sqrt{3} = 0$$

(d)

$$\sqrt{3}y + x - 3 + 2\sqrt{3} = 0$$

Solution

We know that,
for a given line

$$ax + by + c = 0$$

, vector $\begin{pmatrix} a \\ b \end{pmatrix}$
is normal.

$$\sqrt{3}x + y = 1$$

rotated by 120° in the anti-clockwise or 60° in clockwise

Thus, normal vector $= \begin{pmatrix} cos(120^\circ) & -sin(120^\circ) \\ sin(120^\circ) & cos(120^\circ) \end{pmatrix} \begin{pmatrix} \sqrt{3} \\ 1 \end{pmatrix} = \begin{pmatrix} -\sqrt{3} \\ 1 \end{pmatrix}$

The line passing through P $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ and having normal vector as $\begin{pmatrix} -\sqrt{3} \\ 1 \end{pmatrix}$ is equal to

$$\begin{pmatrix} -\sqrt{3} & 1 \end{pmatrix} \begin{pmatrix} X - P \end{pmatrix} = 0$$

$$\begin{pmatrix} -\sqrt{3} \\ 1 \end{pmatrix} \begin{pmatrix} x - 3 \\ y + 2 \end{pmatrix} = 0$$

$$-\sqrt{3}x + y + 2 + 3\sqrt{3} = 0$$

rotated by 60° in the anti-clockwise direction.

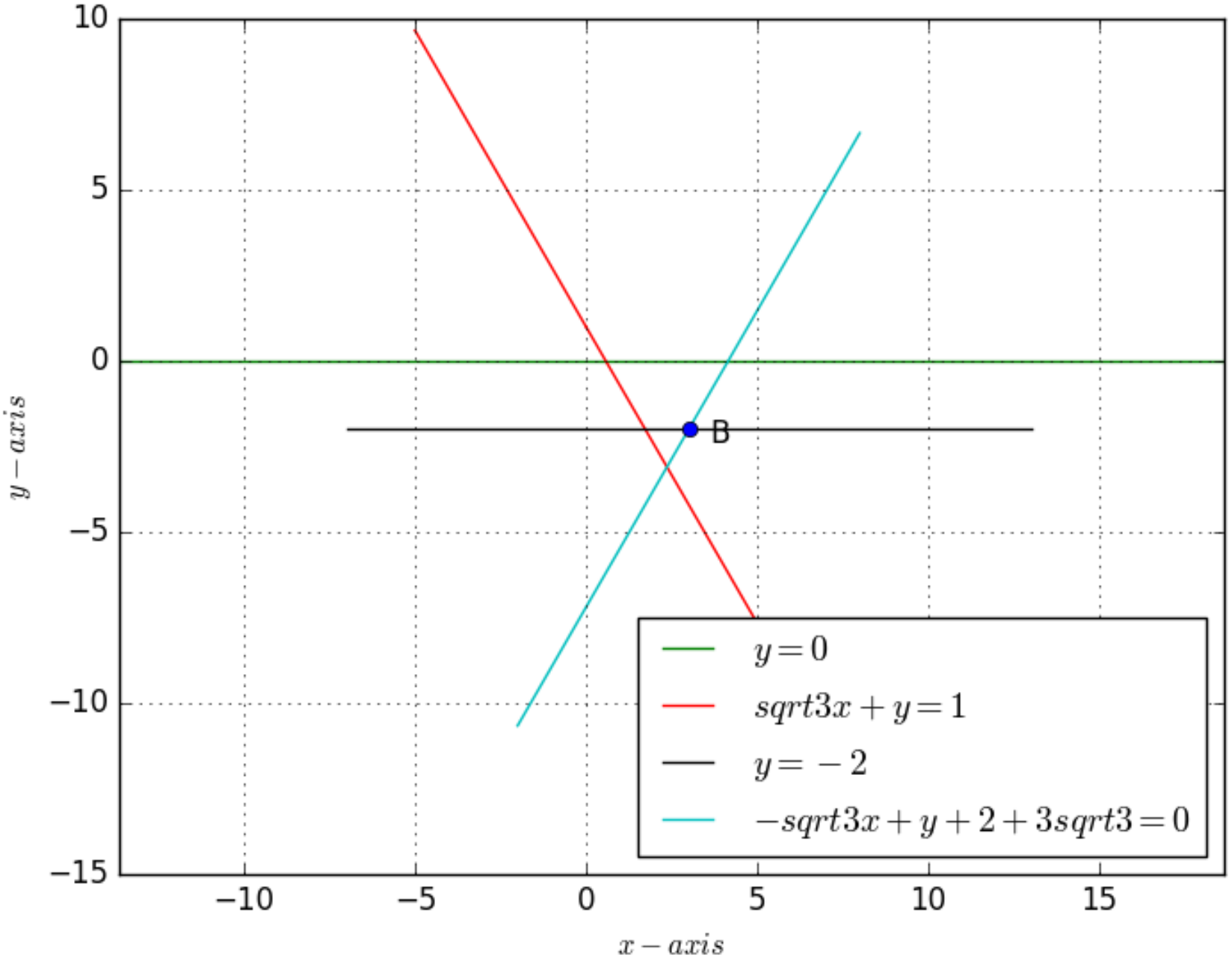
Thus, normal vector $= \begin{pmatrix} cos(60^\circ) & -sin(60^\circ) \\ sin(60^\circ) & cos(60^\circ) \end{pmatrix} \begin{pmatrix} \sqrt{3} \\ 1 \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$

The line passing through P $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ and having normal vector as $\begin{pmatrix} 0 \\ 1 \end{pmatrix}$ is equal to

$$\begin{pmatrix} 0 & 1 \end{pmatrix} \begin{pmatrix} X - P \end{pmatrix} = 0$$

$$\begin{pmatrix} 0 & 1 \end{pmatrix} \begin{pmatrix} x - 3 \\ y + 2 \end{pmatrix} = 0$$

$$y + 2 = 0$$


10
5
0
−5
−10
−15
−10
−5
0
5
10
15
$y-axis$
$x-axis$
B
$y=0$
$sqrt3x+y=1$
$y=-2$
$-sqrt3x+y+2+3sqrt3=0$